

Johnson (W. B.) *al*

Intubation and Tracheotomy in Diphtheritic Croup, with Report of Cases.

Read in the Section on Laryngology and Otology at the Forty-fourth
Annual Meeting of the American Medical Association.

BY WALTER B. JOHNSON, M.D.

SURGEON TO THE PATERSON EYE AND EAR INFIRMARY, PATERSON, N. J.

presented by the author

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INTUBATION AND TRACHEOTOMY IN DIPHTHERITIC CROUP, WITH REPORT OF CASES.

The operation for intubation of the larynx is growing in favor in this country and abroad, although it is not calculated to, and does not, fulfill all the expectations of some of its most enthusiastic advocates; it is an operation, which if performed with reasonable skill and delicacy, is attended with the minimum amount of danger and results in a high percentage of recoveries, considering the dangerous complications which occur in the course of the frequently fatal diseases for which it is performed.

The operation of tracheotomy still has its field of usefulness, and will certainly maintain an important position on the list of scientific surgical procedures, even though it is at present, by many authorities, placed in a secondary position, and in the opinion of the writer of this paper should rarely be performed until after intubation has been thoroughly tried and failed.

Could all the statistics of the operations for intubation of the larynx, performed since the time of its introduction and adoption by the medical profession be gathered together and presented, they would certainly show that hundreds of little sufferers, who would have died of strangulation, have been saved from *that* at least, by the timely introduction of a tube. For, while the percentage of recoveries varies from 27 to 34 per cent., according to the statistical reports of various authorities, the percentage of cases in which the operation was a scientific success and accomplished its mission in relieving the dyspnea,

and in rendering the patient comfortable, even though death eventually ensued, would be very high. Many cases which could never have been reached by any other method have been intubated in consequence of the more general use of the intubation tube, in comparison to the use of the tracheotomy tube, before or during the time of the adoption and performance of intubation.

Even though the percentage of recoveries after intubation, were not higher than the percentage of recoveries after tracheotomy, the number of lives saved would be as much greater, as the proportionate number of intubations would exceed the possible number of tracheotomies which might have been performed if intubation had never been suggested.

Since 1880, when intubation was first proposed by Dr. O'Dwyer, the number of intubators and the number of intubations have increased until they number thousands and there is hardly a city of any importance in the country where the operation for intubation is not performed.

During the time passed in the development of intubation, the number of advocates of tracheotomy as a primary procedure has materially decreased, and the operation has been performed in a comparatively small number of cases, although there are still a considerable number of eminent surgeons who prefer it.

The indications for intubation, are the presence of the characteristic symptoms of laryngeal stenosis and the operation should be performed immediately after these symptoms have developed, and not after the dyspnea has become so severe that great cyanosis and carbonic acid poisoning are present, to complicate the condition, although no case in which the operator is satisfied that dyspnea is due to stenosis should be declined, even though it were apparently *in extremis*, as the operation almost always gives comfort to the patient, and recovery may result in cases seemingly hopeless.

The age of the person should not be especially considered, as the comparative percentage of recoveries after intubation, in cases under three years of age is proportionately very large. The instruments for intubation which have been especially devised by Dr. O'Dwyer are apparently of the best possible size and shape, no suggestion of material value having recently been made, except a change in the shape of the tube, which consists in a decided rounding and flattening of its distal end, which is designed to prevent accidental false passage of the tube through the ventricle of the larynx.¹

Great care should be taken in the selection of instruments, and only those manufactured by reliable manufacturers and made after the most approved and latest pattern accepted. They should be kept perfectly clean and carefully sterilized after each operation and always ready for immediate use. It is very common for the tube indicated as the correct size for a child of a given age, to be difficult of introduction, in which case the substitution of the next size smaller is admissible, as there is very little possibility of the tube passing below the vocal cords, and it is practically impossible for it to pass through the sub-glottic constriction of the larynx without the employment of unjustifiable force.

In addition to the intubation instruments, a complete set of trachea tubes and the necessary instruments for performing tracheotomy should always be carried in the same bag, in order that life may not be lost when the operation for tracheotomy is necessary, or indicated by the occurrence of one or the other of the accidents which may happen during intubation.

¹ Since writing the above, the set of instruments for intubation presented at this meeting of Association by Dr. F. E. Waxham, has been examined and is a decided improvement over the old set, particularly the introducer, which can be thoroughly sterilized and has an obturator attached made from a watch spring which can not kink as it is withdrawn from the tube.

The difficulties which attend the operation for intubation and which are still insurmountable are: the presence of partly adherent membrane, which might be removed were it possible to devise some suitable method of reaching it; the pushing down of membrane before the tube during its introduction which will always be a source of danger, although if proper attention is given to detail in operating, and especially in holding the tube exactly in position during the extraction of the introducer and the subsequent removal of the string; the presence of membrane in or below the tube, occluding it, which must result in the immediate death of the patient unless the tube is coughed out or removed at once. The presence of membrane in the bronchi is a complication which can not be affected, either by intubation or tracheotomy.

Coughing out the tube can not be prevented; it may fall upon the floor or be swallowed, which is not serious as it indicates a probable decrease in the laryngeal edema, and in nearly all cases dyspnea will not return until ample time has elapsed for the intubator to be summoned and to re-introduce the tube. The removal of the tube may be easily and readily accomplished when indicated by the pressure method suggested by Dr. Cheatham of Louisville.

If dyspnea return after relief has occurred from a previous intubation, the tube should be removed on trial and re-introduced, this procedure frequently being beneficial in loosening partly detached membrane. The tube may be removed on trial some time between the fourth and sixth day if the symptoms are favorable, although it is generally safe to leave it, if the patient is doing nicely, until the pharyngeal deposit has cleared up.

The operation for tracheotomy, if for any reason intubation seems impracticable, should be performed at once: when there is irritability of the larynx preventing retention of the tube; when partially detached false membrane frequently embarrasses the

breathing; when frequent plugging of the tube with thick viscid mucus and shreds of membrane persists; when membrane is pushed down before the tube and can not be expelled; when the tube has entered the ventricle of the larynx, making a false passage; when the tube has passed below the true vocal cords and can not be extracted; when there is inability to sufficiently nourish the patient; when there is continued irritation of the bronchi from the excessive aspiration of food.

The difficulty in feeding and properly nourishing the patient after intubation, is one of the most important factors, and certainly militates against a favorable termination, although some improvement has been made and the danger somewhat lessened by the adoption of the posture method of feeding, suggested by Dr. W. E. Casselberry of Chicago.

The inability to sufficiently nourish the patient is undoubtedly a serious drawback to the operation. The feeding should be carefully considered, the physician in charge making it an invariable practice to personally instruct the persons who are to care for the patient, indicating the amount and kind of food to be administered, the proper intervals of time between feeding, and observing that the ability exists to carry out the directions. For it is quite possible that the patient should become discouraged, and the case lost, through violent cough superinduced by injudicious efforts at feeding.

A thorough and complete knowledge of the requisite medical treatment is very essential to the favorable termination of the disease and each step must be carefully marked, and in addition to the general medication, any special symptoms or complications appearing during the progress of the disease must be immediately combated.

The fact that intubation and tracheotomy are purely mechanical procedures, only calculated to carry the patient along until such time as the appropriate medication shall have had the desired effect, must

never be lost sight of, and strict attention given to every detail of the medication, nourishment and care.

There is no question but that the prognosis in either intubation or tracheotomy is materially affected by the variety of the disease, and the presence or virulence of the epidemic, the mortality always being greater at the height of the epidemic, when the ratio of deaths from all causes is greatest and severe complications more apt to be present.

If the dyspnea comes on considerably after the onset of the disease, and membrane has been present in the fauces and disappeared, the prognosis is particularly favorable, especially if the patient is not suffering from severe complications, serious exhaustion or fatal systemic poisoning.

Case 1.—June 29, 1891, in the practice of Dr. D. T. Bowden, a stout, robust, male child, who had been ill five days, although the parents did not think of diphtheria; his throat was sore but he played about until twenty-four hours before present date, when the laryngeal symptoms began to develop and they have increased steadily until present time, with hoarseness, croupy cough and considerable restlessness. Intubation was positively indicated, and was performed at 11:30 A.M. The tube was readily introduced on the first trial but did not give full relief to the dyspnea at first; there was great irritability of the larynx, cough, and occasional stoppage of the expiration, until ten minutes after the tube was introduced, when a complete ring of membrane was expelled about the size of the lumen of the trachea, and about one-half an inch long. After this the relief was complete, the pulse being 130, and the respirations 24 per minute; the temperature 100.

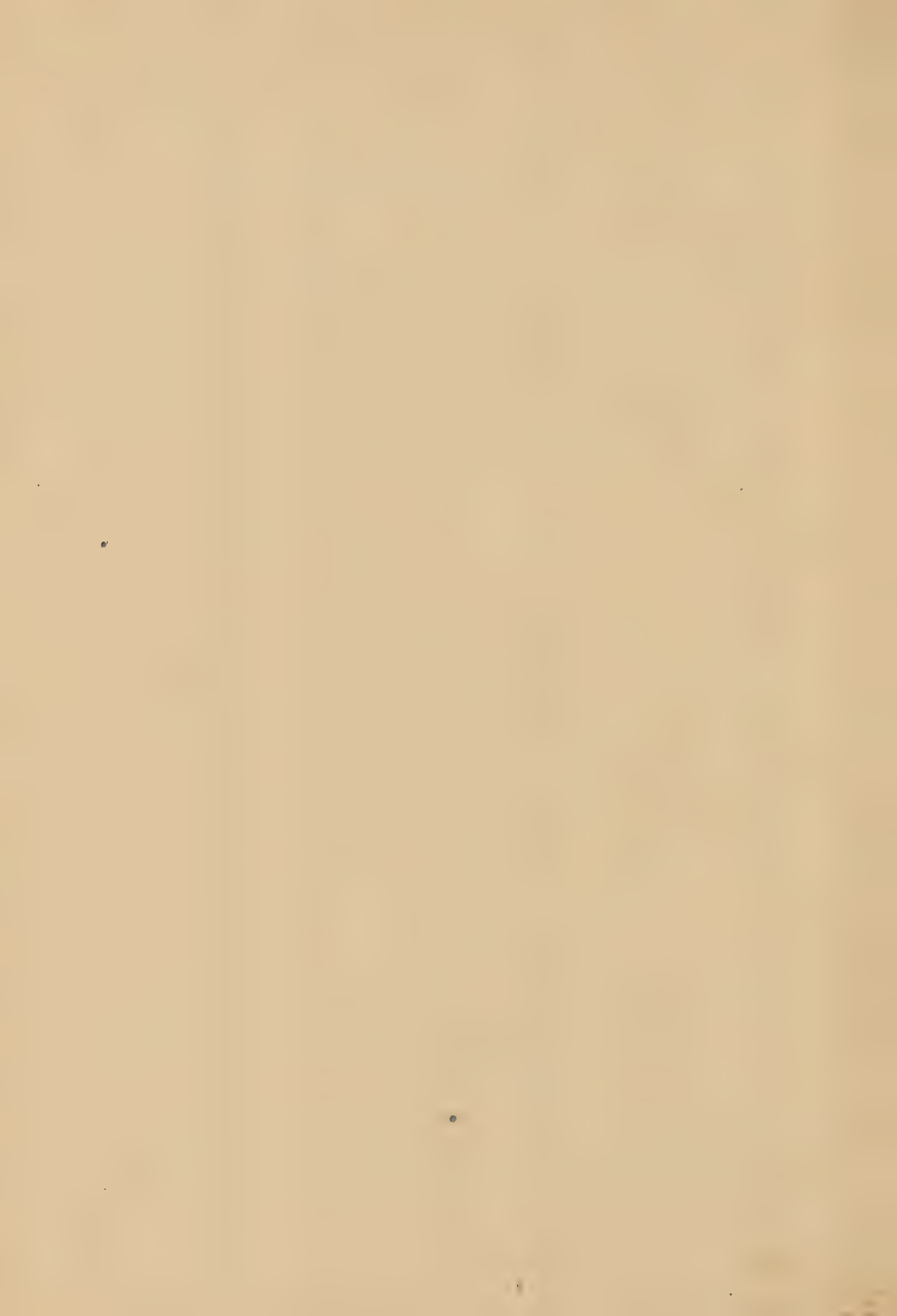
June 29, 5 P.M. The child was fairly comfortable, pulse 142, respiration 28; the air entered lower lobes of the lungs freely; there were some moist râles; was able to take nourishment in Casselberry position; the medical treatment—nourishment, stimulation, bichlorid and calomel.

June 30, A.M. Dr. Bowden has examined his water and reports albumen present in considerable quantity.

June 30, P.M. Child not doing well; respiration increased to 45, and marked sinking of the epigastric region; interference with the respiration. Some bronchial breathing; pulse 160 and feeble. The child has taken fair quantities of nourishment; the tube was removed by the pressure method

The cases here reported, nineteen in number, are tabulated in ready reference. There were six recoveries in all, one of which resulted from an operation for Tracheotomy, which was performed after Intubation had failed. The Tracheotomy was considered necessary in consequence of a feeling of uncertainty regarding the whereabouts of the tube.

Date.	No.	In the Practice of	Sex	Age.	Duration of Laryngeal Symptom.	Duration of Diphtheria.	Cause of Death.	Complications.	Result.	Size of Tube.	Facial Diphtheria.
June, '91.	1	Dr. D. T. Bowden.	M.	3 yr. 10 mo.	24 hrs.	5 days.	Extension to Bronchi.		Died 44 hours after Intubation.	3 to 4	Present.
June, '91.	2	Dr. B. C. Magennis.	F.	2 yr. 11 mo.	30 hrs.	5 days.	Extension to Bronchi.	Loose Membrane.	Died 3 days and 6 hours after Intubation.	2	Well marked.
Aug., '91.	3	Dr. P. A. Harris.	M.	3 years.	24 hrs.	4 days.	Sepsis.	Pulmonary.	Died 36 hours after Intubation, 14 hours after coughed out tube.	3 to 4	Present.
Sept., '91.	4	Dr. W. S. Hurd.	F.	11 months.	24 hrs.	1 week.	Asphyxia.		Died immediately from men-brane pushed down before tube.	1	Present.
Oct., '91.	5	Dr. C. Terriberry.	M.	4 yr. 6 mo.	5 days.	5 days.		Loose Membrane.	Recovered, tube retained 24 hours.	3 to 4	Started in Larynx.
June, '92.	6	Dr. G. W. Terriberry.	F.	3 yr. 6 mo.	30 hrs.	1 week.	Cardiac Paralysis.	Exhaustion.	Died 5 days after Intubation.	2	Present later.
Sept., '92.	7	Dr. Colfax.	F.	1 year.	4 days.	4 days.	Cardiac Paralysis.		Died 15 hours after Intubation.	3 to 4	Present after clearing.
Sept., '92.	8	Dr. J. M. Stewart.	M.	1 yr. 6 mo.	1 days.	4 days.			Recovered. Tube introduced 3 times, retained 10 days.	3 to 4	Slight membrane.
Oct., '92.	9	Dr. H. Banta.	F.	8 years.	24 hrs.	4 days.	Sepsis.		Died 2½ days after Intubation.	3 to 4 & 5 to 7	Present and marked.
Oct., '92.	10	Dr. R. Neer.	F.	9 years.	4 days.	4 days.	Pneumonia.		Died 4 days after Intubation.	5 to 7	No Deposit till later.
Dec., '92.	11	Dr. Filtercroft.	F.	8 years.	2 days.	3 days.	Exhaustion.		Died 6 hours after Intubation.	5 to 7	Marked.
Jan., '93.	12	Dr. P. A. Harris.	M.	4 yr. 6 mo.	2 days.	2 days.	Dyspnea.	Loose Membrane.	Died 12 hours after effort at Intubation.	3 to 4	Very Extensive.
Jan., '93.	13	Dr. Wm. Blundell.	M.	3 yr. 4 mo.	2 days.	1 week.			Recovered. Intubation failed. Operation, Tracheotomy, tube 19 days.	2	Not present till later.
Feb., '93.	14	Dr. J. H. Banta.	F.	6 years.	48 hrs.	3 days.	Pneumonia.	Extension to Bronchi.	Died, tube retained 6 hours.	5 to 7	No membrane present.
Mch., '93.	15	Dr. D. T. Bowden.	M.	4 yr. 6 mo.	5 days.	2 days.	Sepsis.		Died, 24 hours after Intubation.	3 to 4	Thick black membrane.
Mch., '93.	16	Dr. Geo. Fischer.	F.	3 yr. 6 mo.	24 hrs.	48 hrs.			Recovered, tube removed on the 6th day.	2	Considerable membrane.
Apr., '93.	17	Dr. J. M. Stewart.	M.	2 yr. 7 mo.	18 hrs.	5 days.			Recovered, coughed out tube on 4th day.	2	Present.
Apr., '93.	18	Dr. Geo. Fischer.	M.	6 yr. 7 mo.	1 week.	1 week.			Recovered, coughed out tube on 6th day.	3 to 4	Not present till later.
May, '93.	19	Dr. Thos. Paton.	F.	3 yr. 10 mo.	1 week.	1 week.	Exhaustion.		Died 2 days after Intubation.	3 to 4	No membrane.



of Dr. Cheatham of Louisville, without any difficulty or distress, after which a piece of membrane about the size of the first, evidently from the trachea, was coughed up; the dyspnea slightly increased and the tube was re-introduced; there was no improvement, the respirations continued to grow more rapid and shallow and the child died at 7 A.M. July 1, the tube having been retained forty-four hours. In this case the tube failed to reach the disease.

Diphtheritic membrane was present in fauces when first seen by Dr. Bowden; the 3 to 4 tube was used and worn forty-four hours. The principal complication and cause of death was extension of the disease to the bronchi.

Case 2.—June 30, 1891. Hogeman, age 2 years 11 months, a strong, healthy female child, has had diphtheria five days; a patient of Dr. B. C. Magennis. Laryngeal symptoms, thirty hours. Membrane in fauces well marked. The child was almost moribund; respirations catchy.

The tube passed into the esophagus on first trial; tube 2-year size used and passed on second trial; respiration artificial, and raw brandy in mouth finally stimulated cough and child came around; relief of dyspnea complete. Child restless and pulse not good; ordered feeding by posture method; medical treatment, calomel (gr. $\frac{1}{2}$ every two hours).

July 1. Patient has done very well since operation until about 4:30 P.M., when the respirations grew more rapid and difficult. At 5:45 the tube was removed, by Cheatham's pressure method, without difficulty; some pieces of membrane came away with it and in about ten minutes a complete cast of the trachea, which looked much thinner on the lower end as though it had been expelled entire; it was about two inches in length. The child breathed some easier but the cough was very croupy. At 7:30 was hastily called and found the child considerably cyanosed; re-introduced tube and respirations became very quiet and comfortable; the patient was much exhausted and wished to be let alone; did not cough much although there was mucus in the tube; would not expectorate; pulse somewhat irregular; respirations 40 per minute.

July 2. Child passed a very comfortable night, breathing evenly and slowly; the parents report that she took a large amount of nourishment and in the morning was very bright and looked much better, pulse stronger, slower and regular; 140; respirations 36 per minute. In the afternoon the child's respirations became more hurried and restlessness developed, with considerable swelling of the glands of the neck; there was decided evidence of a stoppage from the presence of membrane in the trachea as shown by the puffing out of the suprasternal space at each expiration.

The tube was again removed; she expectorated some pieces of membrane but no cast.

The tube was re-introduced in about an hour. The patient was much exhausted and rallied very slowly; she still had symptoms of stoppage below the tube and the string was left attached to remove tube in case of necessity, but she grew worse until 11 p.m., when she died.

She wore the tube three days and six hours. The disease undoubtedly extended to the bronchi.

Case 3.—August 3, 1891. T. B., male, aged 3 years; in the practice of Dr. P. A. Harris. Was taken ill on Thursday four days before first seen; the case was rather obscure and the parents did not think it very bad; first developed croupy symptoms during Monday morning which increased during the day until evening.

At about 10 p.m., and less than twenty-four hours after the onset of the dyspnea, the child was greatly distressed and could not get sufficient air; had marked episternal sinking and also great sinking over the diaphragm, crowing respiration, and a very stridulous cough. Has been constantly upon the bichlorid treatment.

After being placed in the proper position intubation was attempted but did not succeed until the third trial, the tube passing into the esophagus twice. There was almost immediate cessation of the dyspnea, and the child, soon after the operation, seemed to feel very comfortable. The pulse was 144, the respiration 28, the color good and no stridor on respiration.

August 4. Dr. Harris reports respiration 27, pulse 150; the child is taking very little nourishment and has a severe cough at every effort. Advised Casselberry's method of feeding, and that the head be held low enough to make it absolutely impossible for food to pass into the trachea. In afternoon when coughing, the tube was expelled; the feeding had been easily and successfully accomplished by the Casselberry method.

The child breathed about as comfortably after the tube came out. Five hours afterwards the patient was breathing fairly well, but Dr. Leal stated that the child had lung complication; pulse 150, respiration about 30. The parents would not consent to have a re-introduction of the tube, even if it became necessary; at the time there was not sufficient obstruction to make it advisable. The child had no return of the dyspnea that indicated a re-introduction of the tube, but grew gradually weaker and finally passed quietly away.

Death, caused by sepsis and pulmonary complications, occurred on Wednesday morning, about thirty-six hours after the intubation and fourteen hours after the tube was coughed out.

Case 4.—Sept. 21, 1891. M. D., female child, age 14 months; a patient of Dr. W. S. Hurd. Child had been ill one week; with symptoms of stenosis about twenty-four hours. Had been strong and well but was extremely cyanosed, or rather had the appearance of a child having more difficulty in expiration than in inspiration.

The tube was introduced three times, slipping on two occasions into the esophagus, and when in the larynx not seeming to afford any relief. The child died during the efforts to introduce the tube.

The cause of death was membrane in the trachea which was pushed down before the tube and could not be expelled.

Case 5.—Oct. 9, 1891. Patient of Dr. C. Terriberry; male, 4½ years old. Diphtheritic symptoms first started in larynx five days before; some faucial patches second day after. Moderate temperature. Bichlorid treatment commenced at once; patient gradually grew worse from Saturday until Thursday evening, when he was intubated with instant relief; no difficulty in operating, tube passing in easily. Patient had a good night, taking considerable nourishment.

In the morning Dr. T. reported his temperature 99 1-10, pulse 120, tongue coated, bowels and kidneys acting, the urine being somewhat scanty and very high colored. Breathing about 30, and very comfortable.

At about 3:30 P.M. patient had a choking spell in which he became very much cyanosed and after a severe struggle for breath and hard coughing he quieted down again so that at the time of making visit he was breathing very comfortably; he also spoke in a moderately loud voice, and it seemed as if the tube might have been coughed up and swallowed.

Was sent for at 6 P.M., and was informed that the child had had two such spells, and decided to re-intubate. On examination found the tube in situ, and removed a considerable quantity of mucus; concluded that there was membrane below the tube and that the tube must be removed.

Suddenly expiration ceased and shortly after, inspiration also; he became extremely cyanosed. The spasm came on while trying to induce him to open his mouth to allow removal of the tube; the jaws tightly closed and could not be opened; it seemed as though he was about to die, when finally his jaws were separated and the tube was removed without much difficulty by Cheatham's pressure method; by producing artificial respiration he was induced to breathe again and did so quite comfortably.

At 9 P.M. visited the house again, found him breathing rapidly and with difficulty; he had taken considerable nourishment but the larynx was evidently obstructed. Intubation was suggested but the mother would not consent as she was convinced her child must die. The patient, how-

ever, continued to take the medicine regularly and gradually improved. He finally made an excellent recovery, the tube having remained in place only twenty-four hours.

Case 6.—June 19, 1892. Dr. G. W. Terriber's patient. Female, age $3\frac{1}{2}$ years. One week ago the mother first discovered that the child had sore throat (she is slim, with small neck for her age); she seemed to get on nicely until the afternoon of the 18th, when she began to get hoarse; she gradually grew worse until I saw her on the evening of June 19. Immediate intubation was advised; the procedure was accomplished, the 2-year tube introduced, the impression being that the child was only $2\frac{1}{2}$ years old; it was passed in readily on the second trial with immediate relief of the breathing; she was able to swallow without much difficulty in the Casselberry position, and the string was removed one-fourth of an hour after the intubation.

The child slept well all night and was in good condition in the morning. In consequence of inability to procure the services of a nurse, the child took very little nourishment after the intubation; she seemed to be more restless during the afternoon and evening; the breathing was very comfortable, although considerable quantities of mucus were present; a nurse was secured. The medical treatment consisted of milk and whisky and one thirty-second of a grain of bichlorid every two hours.

June 23, A. M. The child has been fairly comfortable since last note, but has taken only small amount of nourishment; the membrane has about disappeared from the fauces; her pulse has ranged from 124 to 150, and her temperature from 101 to 102.2-5; it came down readily after alcohol baths. Had some difficulty with breathing for two or three hours last night, due to membrane probably about the head of the tube; her respiration has ranged from 24 to 30; her tongue is still very much coated and she complained of some soreness about the throat.

June 24. Patient had a more comfortable night and has taken somewhat more nourishment. Temperature, 100.3-5. There seems to be some reformation of membrane in the pharynx; have used a spray of the peroxid of hydrogen solution. During the afternoon had two or three attacks of cyanosis apparently due to cardiac failure, the respiration being about normal at those times.

The tube was removed and rectal alimentation resorted to; the respirations were not impeded but she continued to sink, and died of exhaustion five days after intubation.

Case 7.—September, 1892. Female, 4 years of age. Dr. Colfax, attending physician. On the fourth day of the disease the patient had a sinking spell with considerable dyspnea in the morning, and Dr. C. thought the child was dead; she rallied, however, and when first seen was laboring

with marked dyspnea, pale and anxious look, feeble and irregular pulse; immediately proceeded to intubate, which was done without any great difficulty on the second trial, although the child became very much exhausted.

There was considerable swelling of the epiglottis; in about twenty minutes the breathing became perfectly easy and the child said she felt very comfortable; she had a very fair pulse and died fifteen hours after the operation, from cardiac paralysis, the respiration having been entirely comfortable and easy to the end.

Case 8.—Male, 4½ years old, patient of Dr. J. M. Stewart. Was called on September 1, p.m. to see the child. He was at that time cyanosed, and had marked sinking on respiration, in the epigastric and suprasternal regions; had cough and difficulty in phonating. He had trouble with the larynx four days, at which time the whole difficulty seemed to commence, he having been playing about all the previous day and had not complained of feeling ill. On examination there was some little deposit on the fauces; the tongue was coated.

The operation was performed without much difficulty but was followed by vomiting of curdled milk. The boy had no trouble in taking a considerable quantity of nourishment in the Casselberry position, or even in eating ice when sitting up at any time during the disease. The tube seemed to cause some cough; his temperature was not high, 100, and he was quite comfortable; he had no complication or drawbacks of any kind. He coughed out the tube on the sixth day, Sept. 7, 1892. September 8, p.m. The tube remained out thirty-six hours, when there seemed to be a return of the bad symptoms, increased temperature and pulse, with difficulty in breathing; decided to re-introduce the tube in the evening; there seemed to be edema about the epiglottis, so that it was difficult to introduce the tube and a 2-year size was tried and introduced easily, but was soon coughed out again when the regular size was again tried and introduced. September 12. The tube is still in place; patient takes his nourishment fairly well; has a temperature varying from 99½ to 101 in the axilla; no deposit in the pharynx, tongue again clearing. September 13, a.m. Tube coughed out; temperature normal; pulse good; the child hungry; breathing comfortable. Uninterrupted recovery.

Case 9.—Oct. 13, 1892. Female, 8 years old; Dr. Banta attending physician. Has had sore throat for four days; trouble with respiration for twenty-four hours; is small for her age. First seen in the morning; better at dinner time. Intubation made at night. Could not introduce the regular sized tube but used a small one 3-to 4-year size, instead of 5 to 7. Relief marked, tube remained in twenty-four hours when it was coughed out followed by increasing dyspnea. Again

intubated at 9 p.m.; succeeded in introducing the 5 to 7 tube with immediate relief. October 15, Doctor reports her having had a good night and her condition improved. The child lived until October 10 a.m., never having any difficulty with breathing and died of sepsis.

Case 10.—Nov. 17, 1892. Dr. R. Neer's case. Female, age 9 years. Patient had increasing hoarseness and cough for four days; there was no indication of a diphtheritic deposit in the pharynx. Her tongue was coated, she had a rapid pulse and great difficulty, especially in inspiration. Marked supra-clavicular sinking; a very hoarse stridulous cough. November 18. The trouble had increased, the dyspnea was attended by the anxious look, but there was still no deposit in pharynx; the pulse was 150 and of poor quality. Intubation was advised and afforded immediate relief. The tube, 5 to 7, was introduced with perfect ease at the first trial. November 19. Dr. Neer reports the case as progressing favorably; pulse and temperature slightly accelerated; great difficulty experienced in the feeding, a slight amount of milk causing her to cough.

November 20. Child bright and feeling very comfortable; says she did not mind the introduction of the tube; that it did not hurt her and made her feel much better; she can take milk in the Casselberry position without coughing much, but she does not like to take it; she drank a wine glass of milk and whisky while Dr. Neer was present. On examination it was thought that there was a suspicion of deposit upon left tonsil. Bowels moved twice during the day. November 21. The child has been very restless and wanted the tube removed; she has some dyspnea, although the day before there was none; there was a characteristic membrane in the fauces. The tube was removed; there was nothing in it; the disease was below the tube. The child died in the evening from pneumonia, having been twelve hours without the tube, the dyspnea not having been marked.

Case 11.—December, 1892. Dr. Fliteroff, attending physician. Female, 8 years old. Had been ill three days; the laryngeal symptoms had been present two days and were very severe; the child was very much exhausted before the operation and the pulse was very rapid and irregular. The diphtheritic deposit was very great. Intubation was performed in the usual manner, a 5 to 7 tube being used. The dyspnea was entirely relieved, but the child never rallied and grew continually weaker until six hours after intubation, when she died from exhaustion.

Case 12.—Jan. 20, 1893. Healey, male, age $4\frac{1}{2}$ years, patient of Dr. Harris; duration of diphtheria forty-eight hours. Membrane below the tube. Death resulted in twelve hours after efforts at intubation. The child had excessive diphtheritic deposits which seemed as if they had

been much longer in coming than the history indicated; the tongue was very much coated and brownish. Patient cyanosed and breathed with great difficulty. The intubation was made six different times, the length of time which the tube could be retained varying from one to four or five minutes, when the expiratory movement would be accompanied by a decided flap of loose membrane over the distal end of the tube; the parents objected to further efforts and the patient was left to die. Tracheotomy was advised but not permitted.

Case 13.—Jan. 24, 1893. Dr. Blundell's patient. Male, 3 years, 4 months old. Patient had had laryngeal trouble every night for a week, but seemed in good health until the evening of the 23d, when he was first seen by Dr. Blundell. At noon on the 24th his dyspnea was so marked that intubation was advised; a small tube (2 years) was used and placed in position without any difficulty, giving great relief until three and one-half hours after, when he had a coughing spell and coughed up a considerable piece of membrane; this effort was accompanied with such severe strangulation that his mother thought he was dying. The dyspnea returned and was as severe as before intubation. On examination the tube could not be found, and as it was small for his age it was feared it might have passed below the vocal cords, and when the tube, size 3 to 4, which was tried, did not slip easily into the larynx, no force was used, but tracheotomy advised and performed in the usual manner.

January 25. He had a fair night and took considerable nourishment. He expectorated during the night a moderate quantity of diphtheritic membrane. Looked very comfortable and did not make any complaint. January 26. Has had one or two attacks of coughing, expelling considerable quantities of diphtheritic membrane; has taken a fair quantity of nourishment; says he has no pain. Temperature 101, pulse 120; has a sore on his lip with diphtheritic deposit on it which seems to be thinning; has taken $\frac{1}{2}$ grain calomel every one and one-half hours. January 27. Has had a temperature of 101.7-10 during the night, coughing more frequently than on the night before. Has a considerable swelling and some deposit about wound which has gaped a great deal since swelling came on and is somewhat red about the edges. He looks well; his tongue is clearing at the end; can not breathe through mouth yet. Temperature 100, pulse 112. January 28. Wound affected with considerable deposit, swelling and redness. Had a hemorrhage from the nose last night, considerable blood came from the tube. His general appearance is good, tongue is clearing and is taking some nourishment. His temperature has not been higher than 100 and his pulse 116; this morning his

temperature is 98, pulse 102, respiration 28 or 30; has swelling about the wound. Ordered peroxid of hydrogen, 15 volume solution to be applied to wound. January 29, P.M. Swelling about wound very much diminished and deposit nearly cleared; he passed a very comfortable night and day; deposit on lip nearly all gone; he is taking increased quantity of nourishment. He had a hemorrhage from the tube, during the night, about one-half teaspoonful of bright red blood; the highest temperature, 99. This evening the temperature is 98 1-10, his pulse 100; his general condition good; he passed intubation tube from bowels; he will not take his medicine.

January 30, A.M. Very comfortable, a few drops of blood coughed up in the night at about 10 A.M., tongue and membrane clearing, increased quantity of nourishment. Pulse 100, respiration 24, temperature normal; he can breathe through larynx with tube closed. January 31 and February 1. Condition has remained the same; have great difficulty in getting him to breathe through his mouth; pulse 100, temperature 98 to 98 7-10, respiration 24 to 28; taking nourishment; no deposit on wound; tongue rather more coated than it has been before. February 2. Condition about the same, except somewhat improved, especially the wound; slight bleeding at times with expectoration. Some milk has passed down and been coughed out of the tube; his urine, which has been scanty is more profuse; his bowels are regular. February 4, P.M. This afternoon removed the tube; it was followed by such great dyspnea that it was necessary to introduce another. The smaller sized tube was used; in introducing the canula during the afternoon a piece of granulation tissue seemed to have been cut off. It was about the size of the fenestra and one thirty-second of an inch thick.

He seemed in good condition this evening; his pulse ran up during and after the re-introduction of tube. In swallowing food, regurgitation of some of the fluid portion occurs. February 5. Temperature ran up to 102, with pulse 120, respiration 36. Child was not restless; gave quinin, ordered mild cathartic as bowels had not moved; had coughed up a great deal of mucus. February 6, A.M. Temperature normal, pulse 109, respiration 30. Bright and feels quite comfortable. February 7. Very well in morning; at noon, temperature 104, respiration 36, pulse 132; granulations around wound very puffy and large; is talking in whispers through mouth; will not permit tube to be corked. February 10. Has had no elevation of temperature since. Each night at about 1 A.M. has a sweat with considerable depression, his pulse becoming soft and much slower. Using glycozone on the wound and applying nitrate of silver to granulations. His urine is clearer, his

tongue still coated; he can speak much better and has had a cork in the tube for half an hour without difficulty of breathing; has less trouble with food passing into the tube. On the nineteenth day after introducing the tube he was induced to have the cork in, which he did and kept it there all day and did not want it removed. In the evening the tube was removed and he has made an uninterrupted recovery.

Case 14.—Feb. 18, 1893. M. Dunning, 6 years; female; patient of Dr. Banta; diphtheria three days. Croup forty-eight hours, increasing; there was some question as to the presence of any diphtheria in this case, no membrane having been seen. February 18, 12 M. was called to see child; seemed fairly nourished, had great dyspnea, some cyanosis, history of previous attacks of inflammatory croup. No membrane in the pharynx; after steaming and slacking lime for two hours and no improvement taking place, her respiration being 37 to 40, her pulse 150 to 160, intubation was ordered and performed, tube, size 5 to 7. The tube necessitated the use of a slight degree of force but was introduced on the first trial. She had immediate relief from dyspnea but did not get into a good sound sleep. She was able to take her nourishment and did so during the night. February 18, 2 P.M. Child found in great discomfort, breathing rapidly and very shallow with some apparent effort but not sufficient dyspnea to indicate any closure around or stoppage in the tube. Her pulse was 180 or more, her temperature 106 $\frac{1}{2}$. She undoubtedly had a very severe attack of pneumonia from which she died twelve hours after intubation.

Case 15.—March 4, 1893. Dr. Bowden's patient, male, 4 $\frac{1}{2}$ years of age. Duration of disease four or five days. Duration of laryngeal symptoms two days; was a strong well-nourished child. Dyspnea very marked, great supra-clavicular sinking and depression of epigastrium on inspiration. Very dark-looking membrane, which was separated during the intubation; the urine was reported scanty and containing considerable quantities of albumen. He has a fairly good pulse; complained of severe headache. The intubation was performed and a piece of membrane from the fauces was drawn into the tube; several trials were made, the tube passing into the esophagus; it was finally introduced and afforded immediate relief. March 5, A.M. Child slept well after the intubation, but was somewhat delirious during the night; takes his nourishment well in Casselberry position. He looked very badly; has a pulse of 160 or more, and rapid respiration without any special dyspnea; no lung trouble apparent; temperature 103, axillary. The child continued to sink and died of sepsis in the afternoon, having no further laryngeal stenosis.

Case 16.—March 29, 1893. Dr. Fischer's patient. Female, 3½ years old. Forty-eight hours since onset of disease and twenty-four hours since laryngeal symptoms developed. Made the intubation without difficulty at 9 A.M. Great dyspnea was present and some cyanosis. The relief was instantaneous. Coughed up considerable mucus, the tongue was coated and the tonsils had considerable membranous deposit. Child went to sleep immediately after the operation.

March 30, A.M. Temperature 100, pulse 130, respiration 24; coughed up some mucus. Dr. Fischer is alarmed at the character of the pulse, which is feeble; otherwise the child is doing fairly well, taking considerable wine and milk. April 2. Child had done well since; respiration 18 or 20; pulse 95, but feeble; temperature from 99 to 100; is troubled by much coughing; takes fluid nourishment fairly well, also wine and brandy and ice-cream. April 4. The child has been very comfortable, the pulse ranging from 95 to 120 and full, the temperature 99 to 99½; the tongue and tonsil have cleared and the child has taken a fair quantity of liquid nourishment and stimulants; there has been but little difficulty with the feeding. The tube was removed by the Cheatham method without difficulty, and the indications pointed to a speedy recovery, the respirations being free and even, and the condition favorable; convalesced rapidly; she wore the tube six days before removed.

Case 17.—April 6, 1893. Male, age 2 years 7 months. Dr. Stewart's patient. Five days since onset; has only had difficulty of breathing about eighteen hours; had great cyanosis and dyspnea. Intubation was made and there seemed to be stoppage at head of tube; could not expectorate a thickropy mucus; respiration rapid and somewhat difficult in the inspiratory movement; no difficulty in expiration. After about an hour seemed to be getting plenty of air and string was removed. April 7. Had a restless night with severe cough; coughed up tube at 8 A.M. At 10:30 was breathing quite comfortably. The child grew gradually worse and was re-intubated at 4:30 P.M. with instant and great relief. April 8. Child has had a comfortable night, has slept well and is in good condition. Temperature normal; has taken considerable nourishment. In the evening Dr. Stewart reports that the child had a severe spell of choking; the parents thought he would die, but was doing well when he saw him shortly after. Great difficulty was experienced in taking food, the paralysis of the fauces causing it to come up through the nose. April 10. The child coughed up the tube four days after intubation. He continued to improve each day from this on, and finally made a perfectly satisfactory recovery.

Case 18.—April 22, 1893. Patient of Dr. Fischer, age 6 years 7 months, male. Diphtheria one week; seemed to

start in larynx. Has had frequent attacks of croup and the parents took this for one of the same and did not immediately call a physician. He continued to grow worse and Dr. Fischer was called; he made a diagnosis of diphtheria and in a few days found membrane in the fauces; the croupy symptoms gradually increased, and all night and the day of the operation were very severe; the child was cyanosed and there was a marked sinking of the epigastric region at each inspiration and a great amount of supra-sternal depression. Intubation was advised and an effort to introduce tube was made; the patient was very docile but all efforts failed. The 3 to 4 tube was then tried and introduced at first trial with immediate relief; he took considerable nourishment in the usual posture, and did not have severe cough, although he did cough up a considerable quantity of thick mucus, just after the intubation. He grew steadily better each day and on Thursday the sixth day after the operation he coughed up the tube, after which he improved steadily. His temperature never ran higher than 101 after the operation. Three other children developed the disease after he did; two of them died of sepsis.

Case 19.—May 12, 1893. Dr. Paton's patient. Female, 3 years and 10 months old. Duration of disease one week; dyspnea gradually increasing. Very much cyanosed and nearing dissolution. There was no evidence of diphtheria.

The first attempt at intubation failed; the second was successful and was followed by coughing and expectoration of a considerable quantity of muco-pus; the breathing was rapid and the child was extremely depressed and had some sickness of the stomach with slight vomiting, but she said she felt comfortable.

May 14. Child seemed better than yesterday when the pulse was 150 and the respiration very rapid. Is taking large quantities of nourishment; pulse 120; respiration 42; seems bright and well; coughs somewhat and expectorates quantities of very thick yellow mucus; there is a decided membranous deposit in the throat on last visit; temperature not taken.

May 14, P.M. The child passed quietly away, without any struggle or difficulty in respiration. Death caused by exhaustion and possible lung complication, two days after intubation.

